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10/603,796	06/26/2003	Chandra Mouli	M4065.0669/P669	3467

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EXAMINER	
MADDEN, GREGORY VINCENT	

ART UNIT	PAPER NUMBER
2622	

DATE MAILED: 11/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/603,796	MOULI, CHANDRA	
	Examiner	Art Unit	
	Gregory V. Madden	2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 June 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-41* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-41* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 August 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 8-11, 30-34, and 36-41 are rejected under 35 U.S.C. 102(e) as being anticipated by Takayama et al. (U.S. Pat. 6,683,643).

First, considering **claim 1**, the Takayama reference teaches an image processing apparatus comprising a storage system for storing first data (dark image, etc.) corresponding to at least one actual image (in memory 5), second data (reference image data) corresponding to both dark current reference images and white reference images captured by a pixel array (CCD 1) (stored in memory 9), and a processor (CPU 6) coupled to the storage system for compensating the first data (dark image, etc.) using the second data (reference image data). Please refer to Fig. 1, Col. 2, Lines 50-57, Col. 4, Lines 47-57, Col. 5, Lines 14-31, Col. 11, Line 47 – Col. 12, Line 8, and Col. 12, Line 53 – Col. 13, Line 17.

Regarding **claim 8**, Takayama discloses a method for pixel compensation comprising capturing, using a pixel array (CCD 1), first data corresponding to both a dark current reference image and a white reference image (reference image data), storing reference data corresponding to the dark current reference image and white reference image in a storage system (memory 9), capturing, using the pixel array (CCD 1), one actual image (dark image, etc.), storing second data corresponding to the actual image in the storage system (memory 5), and compensating the second data (from dark image) using the reference data

(reference image data). Again please refer to Fig. 1, Col. 2, Lines 50-57, Col. 4, Lines 47-57, Col. 5, Lines 14-31, Col. 11, Line 47 – Col. 12, Line 8, and Col. 12, Line 53 – Col. 13, Line 17.

As for **claim 9**, the limitations of claim 8 are taught above, and Takayama further teaches that the act of compensating is performed while a digital camera is in an idle state (e.g. start-up), as taught in Col. 12, Lines 9-14.

In regard to **claim 10**, again the limitation of claim 8 are taught above, and Takayama also discloses that the method further comprises identifying pixels affected by dark current using the dark current reference data (reference image data relating to dark reference image), compensating the second data (dark image taken at start-up) at pixel locations using the reference data, and storing the compensated second data in the storage system (7). See Fig. 1, Col. 2, Lines 50-57, Col. 4, Lines 47-57, Col. 5, Lines 14-31, Col. 11, Line 47 – Col. 12, Line 8, and Col. 12, Line 53 – Col. 13, Line 17.

Regarding **claim 11**, the limitations of claim 8 are taught above, and Takayama teaches that the method comprises identifying pixels as defective pixels (via pixel defect detecting circuit 43) using the reference data (reference image data), compensating the second data (dark image) at pixel locations using the reference data, and storing the compensated second data in the storage system. Again, please see Fig. 1, Col. 2, Lines 50-57, Col. 4, Lines 47-57, Col. 5, Lines 14-31, Col. 11, Line 47 – Col. 12, Line 8, and Col. 12, Line 53 – Col. 13, Line 17.

In regard to **claims 30-33**, the claims are drawn to substantially the same subject matter as that of claim 1, and the Takayama reference teaches the limitations of the claims in Fig. 1, Col. 2, Lines 50-57, Col. 4, Lines 47-57, Col. 5, Lines 14-31, Col. 11, Line 47 – Col. 12, Line 8, and Col. 12, Line 53 – Col. 13, Line 17.

Next, considering **claim 34**, Takayama discloses an image processing apparatus comprising a storage system for storing first data corresponding to at least one actual image (memory 5) and data corresponding to dark current reference images and white reference images (reference image data)

captured by a pixel array (CCD 1), and a processor (CPU 6) coupled to the storage system for compensating the first data (actual image) using the second data (reference image data). Please refer to Fig. 1, Col. 2, Lines 50-57, Col. 4, Lines 47-57, Col. 5, Lines 14-31, Col. 11, Line 47 – Col. 12, Line 8, and Col. 12, Line 53 – Col. 13, Line 17.

Finally, regarding **claims 36-41**, again these claims are drawn to substantially the same subject matter as that of claim 1, and thus the Takayama reference discloses the limitations of claims 36-41 in Fig. 1, Col. 2, Lines 50-57, Col. 4, Lines 47-57, Col. 5, Lines 14-31, Col. 11, Line 47 – Col. 12, Line 8, and Col. 12, Line 53 – Col. 13, Line 17.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2-5, 12, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takayama et al. (U.S. Pat. 6,683,643) in view of Bakhle et al. (U.S. Pat. 6,061,092).

Considering **claim 2**, the Takayama reference teaches all of the limitations of claim 1 above, but Takayama fails to disclose that the storage system stores gain conditions and exposure times associated with both the first and second data, wherein the compensation using the second data involves associating the gain and exposure time of the second data that most closely matches the gain and exposure time associated with the first data. However, the Bakhle reference teaches that gain and exposure settings of the first image (scene image) are stored in a storage system (dark image cache 41), and gain and exposure settings of a second image (dark images) are also stored, wherein the gain and exposure time settings of

the second data (dark images) used in the compensation are those which most closely match the gain and exposure time settings of the first data (scene image) (Please refer to Figs. 2-3, Col. 3, Line 40 – Col 4, Line 32, and Col. 4, Line 66 – Col. 5, Line 54). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have incorporated the use of closely matching gain and exposure time settings for the reference data, as taught by Bakhle, with the compensation system of Takayama. One would have been motivated to do so because by using a cache of previously stored dark reference images to compensate for actual images, a dark reference image does not need to be captured for each actual image in order to correct for dark current noise, etc., thereby reducing the shutter operations and power constraints, as taught by Bakhle in Col. 3, Lines 44-50.

As for **claim 3**, the limitations of claim 2 are taught above, and the Takayama reference discloses that dark current and defective pixel compensation are performed on the first data in Col. 11, Line 47 – Col. 12, Line 8.

In regard to **claim 4**, again the limitations of claim 2 are set forth above, and the Bakhle reference further teaches that the pixel array (36) captures a plurality of dark current reference images (dark images) under a plurality of gain and exposure conditions, and the respective second data corresponding to the plurality of captured dark current reference images is stored along with the associated gain and exposure condition information (dark column reference data) for each dark current reference image in the storage system (cache 41). Again, please refer to Figs. 2-3, Col. 3, Line 40 – Col 4, Line 32, and Col. 4, Line 66 – Col. 5, Line 54.

Next, considering **claim 5**, Takayama in view of Bakhle teaches the limitations of claim 2, and as shown above, the Bakhle reference teaches in Figs. 2-3, Col. 3, Line 40 – Col 4, Line 32, and Col. 4, Line 66 – Col. 5, Line 54 that a plurality of reference images are captured under a plurality of gain and exposure conditions, and the respective second data corresponding to the plurality of reference images is stored along with the associated gain and exposure condition information (dark column reference data) for

each reference image in the storage system (cache 41). While Bakhle only discloses storing dark current reference images in the storage system, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have incorporated the white reference images of Takayama with the storage of reference images based on gain and exposure time settings, as taught by Bakhle. One would have been motivated to do so because it is equally advantageous to detect defect pixels based on white reference images as it is to detect defect pixels based on dark reference images, as pixel defects detected in one method may be missed in another.

As for **claim 12**, the limitations of claim 8 are taught above by Takayama, but like claim 2, Takayama fails to teach that a plurality of dark current reference images under a plurality of gain conditions and exposure times are captured for creating reference data, and for each combination of the plurality of gain and exposure conditions, identifying locations of dark current pixels and hot pixels which require compensation. However, as shown above with respect to claim 2, the Bakhle reference teaches that gain and exposure settings of the first image (scene image) are stored in a storage system (dark image cache 41), and gain and exposure settings of a dark current reference image are also stored, wherein the gain and exposure time settings of the dark current reference images used in the compensation are those which most closely match the gain and exposure time settings of the first data (scene image) (Please refer to Figs. 2-3, Col. 3, Line 40 – Col 4, Line 32, and Col. 4, Line 66 – Col. 5, Line 54).

In regard to **claim 13**, again the limitations of claim 8 are taught above, and as is similarly shown in claim 5 above, the Bakhle reference teaches in Figs. 2-3, Col. 3, Line 40 – Col 4, Line 32, and Col. 4, Line 66 – Col. 5, Line 54 that a plurality of reference images are captured under a plurality of gain and exposure conditions, and the respective second data corresponding to the plurality of reference images is stored along with the associated gain and exposure condition information (dark column reference data) for each reference image in the storage system (cache 41). While Bakhle only discloses storing dark current

reference images in the storage system, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have incorporated the white reference images of Takayama with the storage of reference images based on gain and exposure time settings, as taught by Bakhle.

Claims 6, 7, 14, 15, 20-24, and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takayama et al. (U.S. Pat. 6,683,643) in view of Bakhle et al. (U.S. Pat. 6,061,092) further in view of Houchin et al. (U.S. Pat. 5,047,861).

First, considering **claim 6**, the limitations of claim 5 are taught above, but neither the Takayama nor the Bakhle reference explicitly discloses that the plurality of white reference images are captured under a plurality of light conditions and that the second data corresponding to the white reference images is also stored together with an associated light condition. However, the Houchin reference teaches in Col. 8, Line 60 – Col. 9, Line 12 that a plurality of light conditions are used to capture reference images, and therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to have incorporated the reference images under different light conditions, as taught by Houchin, with the reference image capturing if Takayama in view of Bakhle. One would have been motivated to do so because the plurality of light conditions allows for a far more precise calibration of the reference images than simply two light conditions (e.g. full illumination and zero illumination), thus aiding in the detection of defective pixels under particular conditions.

In regard to **claim 7**, the limitations of claim 6 are set forth above, and the Houchin reference also shows that the plurality of light conditions comprise a no light condition, a first light condition, and a second light condition having a higher Lux value (illumination) than the first light condition. Please refer again to Col. 8, Line 60 – Col. 9, Line 12.

As for **claim 14**, the limitations of claim 8 are taught above, and as is similarly disclosed above with respect to claim 6, neither the Takayama nor the Bakhle reference explicitly discloses that the

plurality of white reference images are captured under a plurality of light conditions and that the second data corresponding to the white reference images is also stored together with an associated light condition. However, the Houchin reference teaches in Col. 8, Line 60 – Col. 9, Line 12 that a plurality of light conditions are used to capture reference images, and therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to have incorporated the reference images under different light conditions, as taught by Houchin, with the reference image capturing if Takayama in view of Bakhle.

Considering **claim 15**, the limitations of claim 14 are set forth above, and the Houchin reference also shows that the plurality of light conditions comprise a no light condition, a first light condition, and a second light condition having a higher Lux value (illumination) than the first light condition. Please refer again to Col. 8, Line 60 – Col. 9, Line 12.

In regard to **claim 20**, Takayama in view of Bakhle further in view of Houchin teaches the limitations of claim 14 above, and the Bakhle reference further teaches that the method further comprises selecting one of the reference data by selecting one of the plurality of gain and exposure combinations based on the gain and exposure combination that most closely matches the gain and exposure combination of the second data, as is taught in Figs. 2-3, Col. 3, Line 40 – Col. 4, Line 32, and Col. 4, Line 66 – Col. 5, Line 54.

As for **claim 21**, the limitations of claim 20 are taught above, and Takayama also discloses that the method further comprises smoothing the pixels affected by dark current using signal values from available neighboring pixels, the pixels affected being identified using the selected reference data, the signal value of each pixel identified as affected by dark current being retrieved from the second data. Please refer to Col. 14, Lines 30-44 and Col. 15, Lines 5-9.

Regarding **claim 22**, the limitations of claim 21 are taught above, and again in Col. 14, Lines 30-44 and Col. 15, Lines 5-9, the Takayama reference teaches that the smoothing is accomplished by averaging the signal values of the neighboring pixels.

Considering **claim 23**, again the limitations of claim 20 are taught above, and the Takayama reference teaches that the method may further comprise scaling down the signal value of a pixel affected by dark current, the pixels affected being identified using selected reference data, the signal value of each pixel identified as affected by dark current being retrieved from the second data. See Col. 14, Lines 30-44.

In regard to **claim 24**, the limitations of claim 24 are taught above, and Takayama further teaches in Col. 14, Lines 30-44 that the scaling down is accomplished by multiplying the signal value by an average signal value for dark current and hot pixels at the selected gain and exposure combination and dividing by the signal value of the pixels to be compensated.

Finally, regarding **claim 35**, the Takayama reference teaches that a storage system stores first data corresponding to an actual image and second data corresponding to a reference image captured by the pixel array, but Takayama fails to disclose that the storage system stores gain conditions and exposure times associated with both the first and second data, wherein the compensation using the second data involves associating the gain and exposure time of the second data that most closely matches the gain and exposure time associated with the first data. However, the Bakhle reference teaches that gain and exposure settings of the first image (scene image) are stored in a storage system (dark image cache 41), and gain and exposure settings of a second image (dark images) are also stored, wherein the gain and exposure time settings of the second data (dark images) used in the compensation are those which most closely match the gain and exposure time settings of the first data (scene image) (Please refer to Figs. 2-3, Col. 3, Line 40 – Col 4, Line 32, and Col. 4, Line 66 – Col. 5, Line 54). What Takayama and Bakhle both fail to disclose is that the storage system processor further stores light condition information for the

second data, but the Houchin reference teaches in Col. 8, Line 60 – Col. 9, Line 12 that a plurality of light conditions are used to capture reference images, and therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to have incorporated the reference images under different light conditions, as taught by Houchin, with the reference image capturing if Takayama in view of Bakhle. One would have been motivated to do so because the plurality of light conditions allows for a far more precise calibration of the reference images than simply two light conditions (e.g. full illumination and zero illumination), thus aiding in the detection of defective pixels under particular conditions.

Claims 16-19 and 25-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takayama et al. (U.S. Pat. 6,683,643) in view of Bakhle et al. (U.S. Pat. 6,061,092) further in view of Houchin et al. (U.S. Pat. 5,047,861) and still further in view of Baharav et al. (U.S. Pat. 6,737,625).

Considering **claims 16-19**, the limitations of claims 14 and 15 are taught above, but none of the Takayama, Bakhle, nor Houchin references specifically discloses that reference data is created for dark dead pixels, white dead pixels, saturation dead pixels, and bad pixels. However, as the Baharav reference teaches in Col. 1, Lines 43-57, dark dead pixels, white dead pixels, saturation dead pixels, and bad pixels are all common forms of defective pixels, and therefore it would have been obvious to one of ordinary skill in the art to have incorporated the defective pixel compensation method of Takayama in view of Bakhle further in view of Houchin so as to compensate for dark dead pixels, white dead pixels, saturation dead pixels, and bad pixels. One would have been motivated to do so because correcting for defective pixels using all of the above reference data ensures the highest quality image possible under a variety of image-taking conditions.

Next, as for **claims 25-28**, the limitations of claims 16-19 are taught above, respectively, and while Takayama in view of Bakhle further in view of Houchin still further in view of Baharav does not

expressly teach that the dead and bad pixels are scaled in various ways based on different light conditions, Official Notice is hereby taken that it would have been obvious to scale the different types of dead and bad pixels in different ways under different lighting conditions because each type of dead pixel is detected using such different lighting conditions, and thus by scaling the signal value up or down based on the specific type of dead pixel detected, each pixel can be effectively corrected to create an image having few defects.

Finally, regarding **claim 29**, the limitations of claim 28 are shown above, and while none of the reference directly discloses that the method of claim 28 further comprises color compensating bad pixels using a formula based on the number of defective colors for the bad pixels, Official Notice is hereby taken that color compensating bad pixels is well-known to those of ordinary skill in the art and would have been advantageous to one of ordinary skill in the art because color compensating bad pixels allows for defective pixels to be corrected to the specific color desired in the scene, as opposed to simply correcting the luminance level of the pixel.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Nakata et al. (U.S. Pat. 6,747,696)

Bloom (U.S. Pat. 7,113,210)

Yoshida (U.S. Pat. 6,992,712)

Harada (U.S. Pub. 2002/0015111)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregory V. Madden whose telephone number is 571-272-8128. The examiner can normally be reached on Mon.-Fri. 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ngoc Yen Vu can be reached on 571-272-7320. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Gregory Madden
October 24, 2006

NGOC-YEN VU
SUPERVISORY PATENT EXAMINER